

REMARKS

Claims 1-3, 6-12, 14-25, 27-29, 31-32 and 34-37 are pending, of which claims 1 and 24 are independent claims.

The withdrawal of the previous rejections based on Reilly/Tanuma and Reilly/Velsko is gratefully acknowledged.

In the Office Action, claims 1-3, 6-7, 15, 17-22, 24-28, 31-32 and 34-37 are rejected under 35 U.S.C. § 103(a) as being obvious based on a combination of Tanuma (US 5561550) and Chandra (6052218), and the other claims are rejected based on Tanuma and Chandra in combination with other references. These rejections are respectfully traversed.

Claim 1 recites a system for coherent beam combination which includes at least two parametric gain media located within an unstable resonator. A first electromagnetic field produced by a first gain medium of the at least two gain media propagates through a portion of a second gain medium of the at least two gain media after one or more roundtrips within the unstable resonator, and the first electromagnetic field is in-phase with a second electromagnetic field produced by the second gain medium. The at least two gain media are placed in a plane transverse to a longitudinal axis of the unstable resonator, and each gain medium is positioned an equal distance away from and on a different side of the longitudinal axis of the unstable resonator.

Tanuma shows an unstable optical resonator that employs a nonlinear optical medium 20 such as lithium niobate. However, Tanuma is seen to show only one such medium 20 disposed in the optical resonator.

Chandra shows an optical parametric amplifier that employs a "matrix" or array 20 of optical parametric amplifiers (OPAs). The array 20 is located between a beam combiner/splitter 14 and a reflective phase conjugator 24. In operation, an input signal 10 is combined with a pump signal 16 in the combiner/splitter 14 to form combined beam 18 which travels a linear path through the array 20 to the phase conjugator 24 and back again (see beams or "phase fronts" 18, 22, 26, 30). The returning beam 30 is directed to a separator

32 and isolator 12 which reflect off the amplified signal beam 36 and idler beam 34 respectively. Chandra does not show an oscillator in which a light beam makes multiple passes through the OPA array 20. Specifically, Chandra does not show an unstable resonator in which an electromagnetic field produced by a first gain medium of the array 20 propagates through a portion of a second gain medium of the array 20 after one or more roundtrips. In Chandra, light passes through each element of the array 20 in a linear fashion, and light passing through any one element of the array 20 is not seen to propagate through any other elements of the array 20.

Claim 1 is not obvious in view of Tanuma and Chandra because these references do not (either individually or taken together) teach or suggest all the elements of claim 1. Specifically, these references fail to teach or suggest system includes at least two parametric gain media in an unstable resonator and in which a first electromagnetic field produced by a first gain medium of the at least two gain media propagates through a portion of a second gain medium of the at least two gain media after one or more roundtrips within the unstable resonator and in which the first electromagnetic field is in-phase with a second electromagnetic field produced by the second gain medium. Tanuma teaches only an unstable resonator with a single medium 20. And while Chandra shows an array 20 of OPA media it is only within an amplifier having a linear optical path in which no light that passes through a given element of the array 20 passes through any other elements of the array 20. Thus these references do not teach or suggest the above-recited aspects of claim 1.

It is acknowledged that (as noted in the Office Action) Chandra attributes "scalability in energy" to the use of the array 20. However, Chandra also discusses the problem of beam front distortion created by using such arrays (see Background, col. 1 lines 45-60). Chandra addresses this problem by using the phase conjugator 24. It is clear that in Chandra the various beams 18, 22, 26 etc. are all ideally collimated, cylindrical beams. There is no suggestion in Chandra that it would even be possible to incorporate an array such as array 20

into an unstable resonator with its diverging beam paths such as shown in Tanuma, either with or without a phase conjugator 24, and certainly neither Chandra nor Tanuma teaches how to do so.

Additionally, while the Office Action alleges that it would be desirable to “incorporate [into the resonator of Tanuma] the use of a phase conjugate mirror to reduce phase front degradation and beam divergence,” this assertion is not believed to be true nor is it seen to be supported by Tanuma or Chandra in any event. The problem of phase front degradation arises due to the use of an array 20, and is not seen to be present in a system such as that of Tanuma having a single OPA crystal 20. Likewise beam divergence is an issue in a linear optical amplifier but is actually a desired property in an unstable resonator of the type shown in Tanuma. And in any event, even if there is some motivation to use the phase conjugator 24 of Chandra in the resonator of Tanuma, it does not follow that therefore the array 20 should also be used in the resonator. The phase conjugator 20 is necessitated by the use of the array 20 (to compensate for its undesirable effect on the beam front), not vice-versa. If Tanuma/Chandra somehow motivate the use of a phase conjugator in an unstable resonator, there would be no reason to also include the array 20 and therefore such a combination would still lack the at least two gain media and related features recited in claim 1.

Based on the above, the Tanuma and Chandra references do not teach or suggest all the elements of claim 1, and therefore cannot render claim 1 obvious under 35 U.S.C. §103(a). Accordingly, claim 1 is seen to be allowable in view of these references.

Because the remaining claims incorporate, either directly or indirectly, the above-discussed features of claim 1, the remaining claims are also seen to be allowable in view of Tanuma, Chandra and the other art of record.

-5-

Conclusion

In view of the foregoing remarks, this Application should be in condition for allowance. A Notice to this affect is respectfully requested. If the Examiner believes, after this Response, that the Application is not in condition for allowance, the Examiner is respectfully requested to call the Applicant's Representative at the number below.

Applicant hereby petitions for any extension of time which may be required to maintain the pendency of this case. If there is a fee occasioned by this response, including an extension fee, that is not covered by an enclosed check, please charge any deficiency to Deposit Account No. 50-3661.

If the enclosed papers or fees are considered incomplete, the Patent Office is respectfully requested to contact the undersigned collect at (508) 616-2900, in Westborough, Massachusetts.

Respectfully submitted,

/James F. Thompson/

James F. Thompson, Esq.  
Attorney for Applicants  
Registration No.: 36,699  
Bainwood, Huang & Associates, L.L.C.  
2 Connector Road  
Westborough, Massachusetts 01581  
Telephone: (508) 616-2900  
Facsimile: (508) 366-4688

Attorney Docket No.: 1002-009.004

Dated: July 20, 2007